(12) UK Patent Application (19) GB (11) 2 336 344 (13) A

(43) Date of A Publication 20.10.1999

(21) Application No 9807685.4

(22) Date of Filing 14.04.1998

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(51) INT CL^6
B60C 15/00

(52) UK CL (Edition Q)
B7C C3B17
U1S S1825

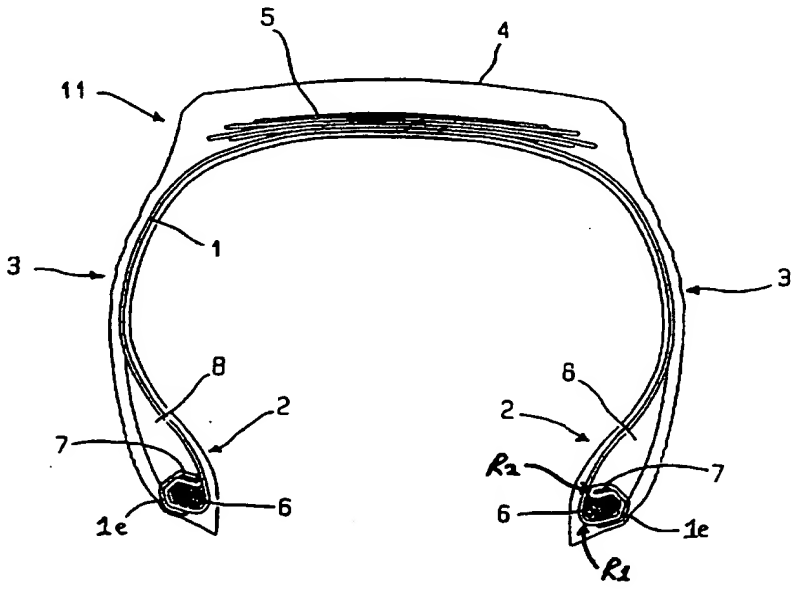
(56) Documents Cited
GB 2179009 A **GB 1046555 A** **GB 0973246 A**
US 4854361 A

(58) Field of Search
UK CL (Edition P) **B7C CDH CRA CRE CRX**
INT CL^6 **B60C 15/00**
Online: WPI

(54) Abstract Title
Pneumatic tyre

(57) A pneumatic tyre has a carcass reinforced by at least one carcass ply 1 of radially disposed cords extending between two bead regions 2 and anchored therein, wherein in each bead region the carcass ply turns radially outwardly in a first turnround region R1 around a first annular bead core 6 then radially inwardly in a second turnround region R2 around a second annular bead core 7, the second region being outward of the first region. The second bead core may be a continuous ring eg of flat profile or a helical winding of single or multiple layers of eg filaments, cord or wire.

FIG. 1



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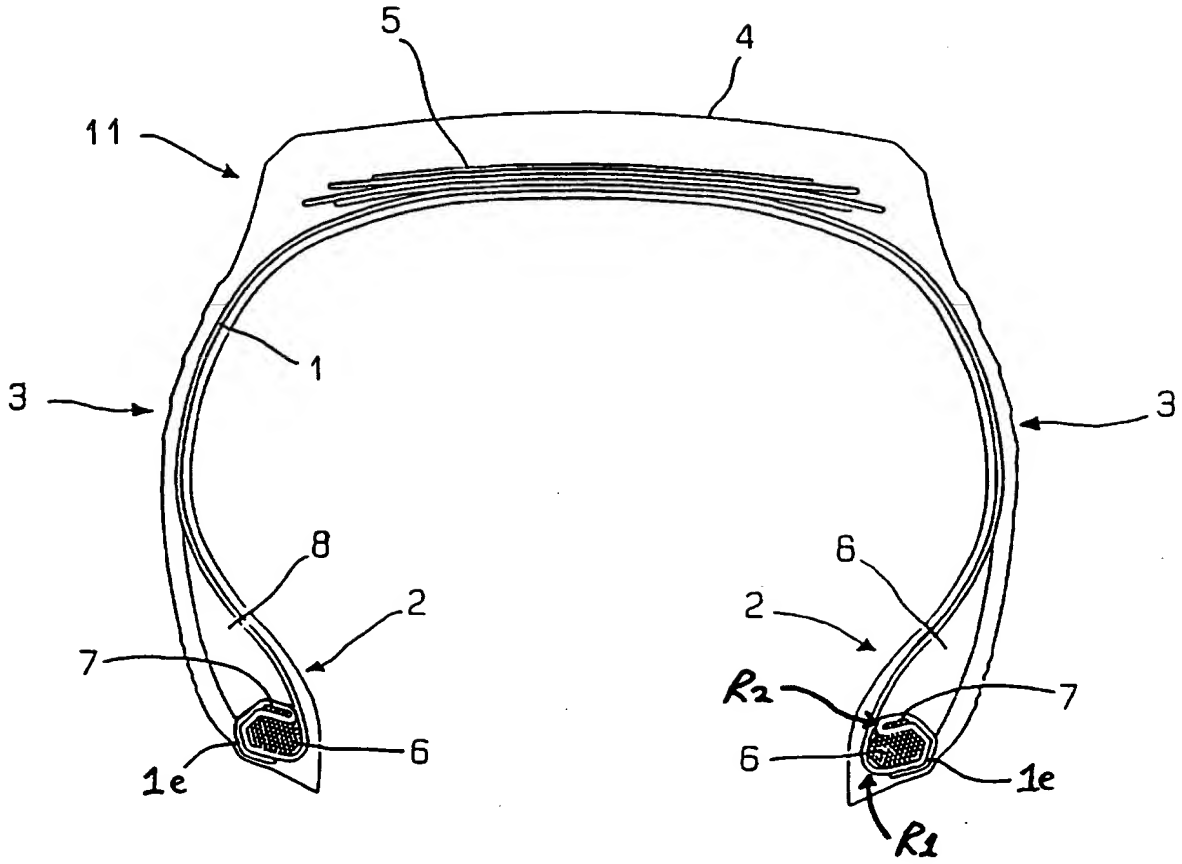
This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

FIG. 1



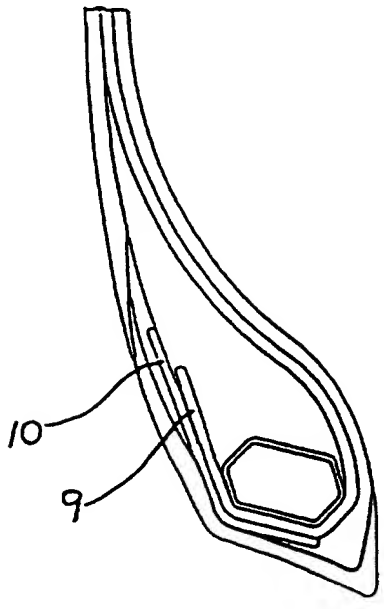


FIG. 2

FIG. 3

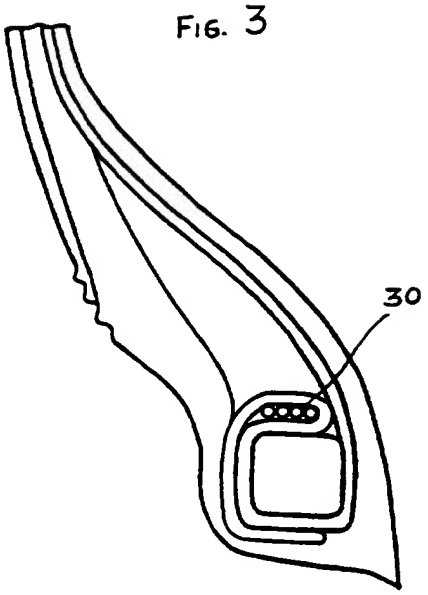
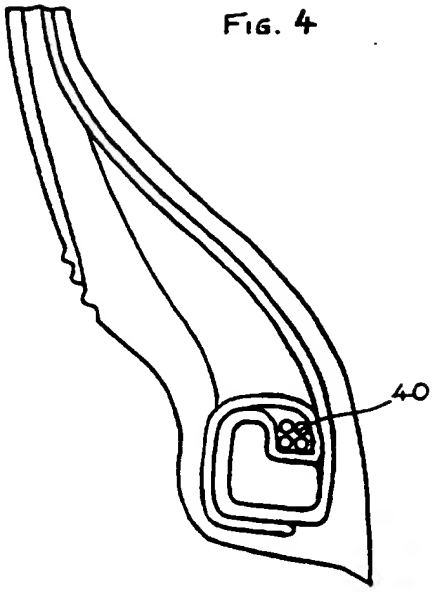


FIG. 4



PNEUMATIC TYRE

This invention relates to a pneumatic radial tyre, and particularly but not exclusively to tyres for motorcycles.

The conventional radial tyre comprises a carcass reinforced by a single carcass ply of cords extending between two bead regions. In each bead region of the tyre the carcass ply is wrapped or turned around an inextensible bead core, which extends in the circumferential direction of the tyre providing a reinforcing bead hoop, to form a ply turn-up which serves to anchor the end of the ply in the bead region.

The present invention is applicable to any radial tyre having a reinforcing carcass ply or plies which are turned around a bead core.

For example, conventional heavy duty tyres utilise metal carcass ply cords comprising steel wires which are surface coated with brass to promote adhesion to rubber. A plurality of such cords are arranged in parallel orientation and embedded in a matrix of uncured rubber known as a topping or skim coat to

form a sheet of ply fabric. This ply fabric is then cut substantially perpendicular to the cord direction at a width corresponding to the cord length in the tyre cross-section. Accordingly the ply turn-up edge in each bead region and particularly the cord ends in said ply are sharp resulting from being cut from the fabric sheet and are also devoid of brass coating across the cut face and hence devoid of adequate adhesion to rubber at the tip.

During running of the tyre the bead regions in which the ply turn-ups are formed are subjected to high levels of stress. Such high levels of stress combination with the above-mentioned features of the ply turn-up edge tend to cause premature failure of the tyre bead region due to ply edge looseness and cracking initiated by the repetitive cutting action of the cord end during flexing of the bead region.

The conventional method employed to combat such premature failure of the tyre bead region, shown in Figure 2, is to position axially outward of the ply turn-up (9) a bias-cut metal cord fabric (10), commonly known as a "filler" or "flipper", which extends around the circumference of the bead region

lying with its edges radially inwards and outwards of the ply turn-up dge. Such a filler (10) in the bead region mitigates the effects of high stress by stiffening the bead region in addition to protecting the ply turn-up edges from accidental damage. However, although the metal cords of the filler are conventionally of thinner gauge than the ply cords, the cut ends of the metal filler cords are themselves prone to cause similar failures as those caused by the ply turn-up ends.

In contrast to heavy duty truck and bus tyres, motorcycle and passenger vehicle tyres conventionally comprise carcass ply reinforcing cords of organic materials such as nylon, rayon, polyester, aromatic polyamide or the like. Whilst such organic cords do not suffer from the edge cutting problem associated with steel cords, in use the bead regions are subjected to very high levels of stress and are similarly prone to ply turn-up looseness which leads to premature failure of the tyre.

A further problem concerning carcass turn-up portions occurs during manufacture of the tyre when tension induced in the ply during both shaping and

moulding of the green tyre can cause the carcass to pull back around the bead core. This process is somewhat uncontrollable and local variations give rise to lack of uniformity in the moulded tyre.

It is therefore an object of the present invention to provide a pneumatic radial tyre which solves the aforementioned problems.

According to one aspect of the present invention a pneumatic tyre comprises a carcass reinforced by at least one carcass ply of radially disposed cords extending between two bead regions and anchored therein, characterised in that in each bead region the carcass ply in a first turnround region is turned in a first turning direction radially outward around a first or main annular bead core and in a second turnround region longitudinally outward of the first turnround region the ply is turned in a second turning direction radially inwardly around a second or anchoring annular bead core.

The second or anchoring hoop may comprise a continuous ring of for example a strip of flat profile or a helical winding of a single or multiple layers of for example filaments, cord or wire.

The anchoring hoop preferably comprises a substantially inextensible material and may be steel or aromatic polyamide or it may be a heat shrinkable material. The anchoring hoop may comprise a plastics material.

Further aspects of the present invention will become apparent from the following description by way of example only of one embodiment of the invention in conjunction with the following drawings in which:

Figure 1 is a schematic drawing of a radial cross-section of a tyre of the present invention;

Figure 2 is a schematic cross-section drawing showing the details of the bead region of a prior art tyre; and

Figures 3 and 4 are schematic cross-sectional drawings showing further tyre bead regions according to the present invention.

Figure 1 shows a radial cross-section of a heavy duty tyre. This tyre 11 comprises a carcass reinforced by a radial carcass ply 1 extending between two bead regions 2, through sidewall regions 3 to a tread region 4. The carcass ply 1 comprises a fabric of rubber coated cords. In the tread region a reinforcing belt package 5 is disposed

radially outside the carcass ply 1. In each bead region 2 the carcass ply is wrapped in a first turnround region R1 radially outwardly around a first or main bead core 6, comprising spiral windings of a steel wire formed into an inextensible hoop, from the axial inside to the axial outside. The carcass ply 1 is wrapped around the bead core 6 for substantially the whole of the cross-sectional periphery of the bead core 6. Thereafter the carcass ply 1 is turned in a second turnround region R1 radially inwardly around an additional second bead core or anchoring hoop 7. The turning direction of the ply around the anchoring hoop is opposite to that around the main bead core 6. This anchoring hoop 7 is a continuous ring comprising in cross-section a flat steel strip tapered outwardly from the axial inside to the outside at the same angle as the radially outer surface of the bead core hoop 6. Disposed axially outward of the main ply portion 1 and radially outwardly of the bead core 6 is a hard rubber apex 8 which extends radially outwardly in an approximately triangular cross-section.

The carcass ply end region 1e lies adjacent to the carcass ply in the first turnround region R1 around

the main bead core 6. The ply end lies radially inward of the main bead core in the region of the tyre bead base.

The anchoring hoop 27 may comprise a continuous ring having a flat cross-section profile as previously described or it may have any suitable profile such as round or square.

Alternatively the anchoring hoop 27 may comprise a spiral or helical winding of a single layer 30 as shown in Figure 3 or multiple layers 40 as shown in Figure 4. The anchoring hoop may be coated with a vulcanisable rubber as conventional in the art to promote adhesion to the ply and other adjacent components of the tyre, or it may be coated with any other adhesive suitable for bonding to rubber.

The anchoring hoop may comprise a heat shrinkable material which permits fabrication of the tyre bead region but which then at the time of fabrication or subsequently in the hot vulcanisation process, is shrunk to anchor the ply by compression between the ring and the bead core hoop.

Also the cross-section shape of the main bead core hoop 6 may be such as to accommodate the additional anchoring hoop 7 within its overall shape as shown in Figure 4. In this way the main bead core 6 and the anchoring hoop 7 fit together in a form-matched manner.

Whilst the invention has been described by reference to a tyre in which the carcass ply is wrapped around the bead for substantially the whole of its cross-sectional periphery the invention has been found effective when the carcass ply wraps only part of the bead core. However it is preferably that a proportion in excess of 80% of the cross-sectional periphery of the bead core hoop is wrapped by the ply.

The above-described ply anchoring system has been shown to improve the bead regions of tyres and particularly to improve the manufacture and performance of motorcycle tyres wherein large tensions occur in the ply cords.

CLAIMS

1. A pneumatic tyre comprising a carcass reinforced by at least one carcass ply of radially disposed cords extending between two bead regions and anchored therein, characterised in that in each bead region the carcass ply in a first turnround region (R1) is turned in a first turning direction radially outward around a first or main annular bead core and in a second turnround region (R2) longitudinally outward of the first turnround region the ply is turned in a second turning direction radially inwardly around a second or anchoring annular bead core.

2. A pneumatic tyre according to claim 1, wherein the first turning direction is the opposite direction to the second turning direction.

3. A pneumatic tyre according to either of claims 1 or 2, wherein the ply end region lies adjacent to the first turnround region.

4. A pneumatic tyre according to claim 3, wherein the ply end region lies radially inward of the radially innermost bead core.

5. A pneumatic tyre according to any of claims 1 to 4, wherein the second annular bead core is radially outward of the first annular bead core.

6. A pneumatic tyre according to any of claims 1 to 5, wherein the first annular bead core is axially inward of the second annular bead core.

7. A pneumatic tyre according to any of claims 1 to 6, wherein the first and second annular bead cores have complementary-shaped adjacent surfaces such that the two fit together in a form-matched manner.

8. A pneumatic tyre according to claim 7, wherein the second annular bead core comprises a helical winding of an inextensible material.

9. A pneumatic tyre according to claim 8, wherein the inextensible material is an aramid cord.

The Patent Office

4

Applicati n No:	GB 9807685.4	**Examiner:**	Paul Foot
Claims searched:	1-9	**Date f search:**	22 October 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): B7C: CDH, CRA, CRE, CRX

Int Cl (Ed.6): B60C: 15/00

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2179009A	(APSLEY) see esp. fig. 4	1, 2, 7, 8
X	GB1046555A	(MICHELIN) whole document relevant	1-4, 6
X	GB0973246A	(DUNLOP) whole document relevant	1-3, 6
X	US4854361A	(GASOWSKI ET AL) whole document relevant	1, 2, 7

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.